Lloyd's Register

Rules and Regulations for the Classification of Inland Waterways Ships, November 2008

Notice No. 6

Effective Date of Latest Amendments:

See page 1

Issue date: August 2010

RULES AND REGULATIONS FOR THE CLASSIFICATION OF INLAND WATERWAYS SHIPS,

November 2008

Notice No. 6

This Notice contains amendments within the following Sections of the *Rules and Regulations for the Classification of Inland Waterways Ships, November 2008.* The amendments are effective on the dates shown:

Part	***Chapter***	***Section***	***Effective date***
4	3	4	Corrigendum
5	1	5	Corrigendum
5	2	3	1 July 2010
5	2	1	Corrigendum
5	4	3	Corrigendum
5	10	4, 8	Corrigenda
5	11	2, 6	Corrigenda
5	12	4	Corrigendum
5	13	1, 3	Corrigenda
5	14	2, 3	Corrigenda
5	15	3	Corrigendum
5	17	1, 2	Corrigenda
6	2	10	Corrigendum

The *Rules for Inland Waterways* are to be read in conjunction with this Notice No. 6.
The status of the Rules is now:

Rules for Inland Waterways	Effective date:	November 2008
Notice No. 1	Effective date:	1 March 2009
Notice No. 2	Effective date:	1 April 2009
Notice No. 3	Effective date:	1 July 2010 and Corrigendum
Notice No. 4	Effective date:	1 July 2010 and Corrigenda
Notice No. 5	Effective date:	1 March 2010 and Corrigenda
Notice No. 6	Effective date:	1 July 2010 and Corrigenda

Part 4, Chapter 3
Pontoons

CORRIGENDUM

■ *Section 4* Hull envelope framing (longitudinal or transverse framing)

4.1 General

Table 3.4.1 Hull envelope framing (*see continuation*) (*Part only shown*)

Item	Parameter	Requirements
(15) Pillars	Cross-sectional area	$\cancel{A_p = \dfrac{P}{1,26 - 4,2\sqrt{r}}\ \text{cm}^2}$ $A_p = \dfrac{P}{1,26 - 4,2\dfrac{l}{r}}\ \text{cm}^2$
	Minimum wall thickness of hollow pillars	The greater of: (a) $t = 0,033d_p$ mm for tubular pillars $t = 0,056b$ mm for square pillars (b) $t = 5$ mm

Part 5, Chapter 1
General Requirements for the Design and Construction of Machinery

CORRIGENDUM

■ *Section 5* Propulsion redundancy

5.1 Shaft system and bow thruster

5.1.2 Passenger ships having a loaded waterline length exceeding 25 m shall be fitted with:

- A second independent propulsion system capable of propelling the ship ~~by malfunctioning~~ in case of failure of the main propulsion system.
- The second independent system is to be installed in a separate machinery space, if both machinery spaces have a common boundary it is to be insulated to A60 Standard.

Part 5, Chapter 2
Oil Engines

CORRIGENDUM

Section 1
Plans and particulars

1.1 Plans

(*Part only shown*)

1.1.1 The following plans and particulars as applicable are to be submitted for consideration:

- Schematic layouts of the following systems, *see also* 1.1.4:
  - Starting air.
  - Fuel oil.
  - Lubricating oil.
  - Cooling water.
  - Control and safety.
  - Hydraulic oil ~~(for valve unit)~~.

Effective date 1 July 2010

Section 3
Design

3.3 Symbols

(*Part only shown*)

3.3.1 For the purposes of this Chapter, the following symbols apply (*see also* Fig. 2.3.2):

σ_{ax} = alternating axial stress, in N/mm^2

σ_b = alternating bending stress, in N/mm^2

σ_{BON} = alternating bending stress in the outlet of the oil bore, in N/mm^2

σ_p, σ_j = maximum bending stress in pin and main journal taking into account stress raisers, in N/mm^2

σ_{BO} = maximum bending stress in the outlet of the oil bore, in N/mm^2

σ_Q = alternating direct stress, in N/mm^2

σ_u = specified minimum UTS of material, in N/mm^2

σ_y = specified minimum yield stress of material, in N/mm^2

τ_a = alternating torsional stress, in N/mm^2

τ_p, τ_j = maximum torsional stress in pin and main journals taking into account stress raisers, in N/mm^2

τ_{tob} = maximum torsional stress in outlet of crankpin oil bore taking into account stress raisers, in N/mm^2.

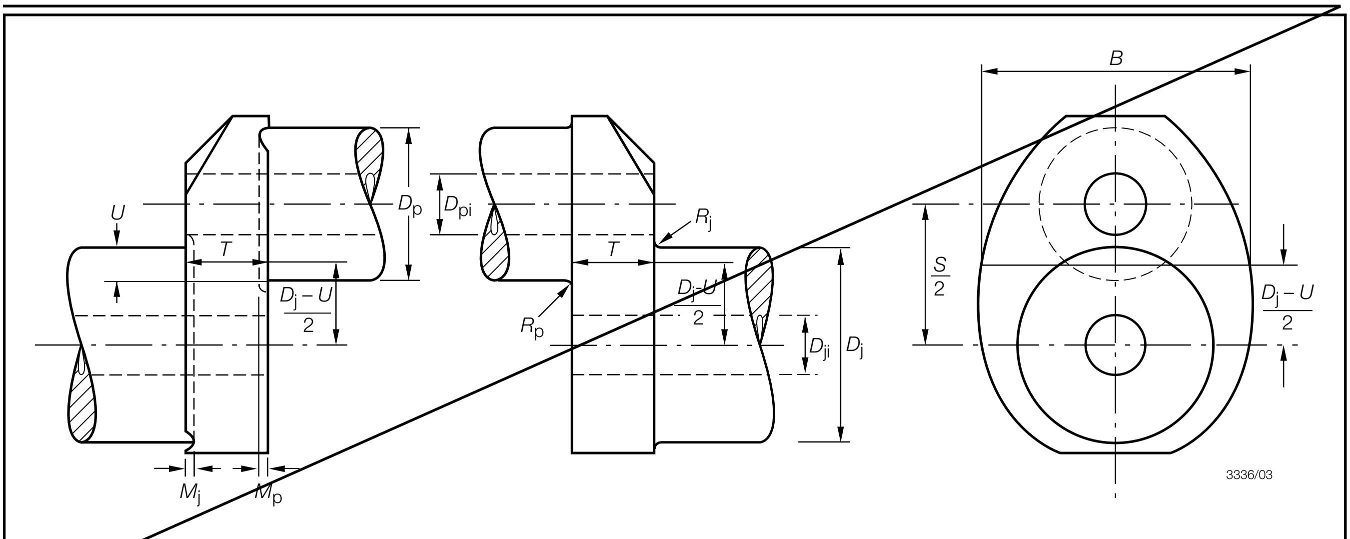

Fig. 2.3.2 Crank dimensions necessary for the calculation of stress concentration factors

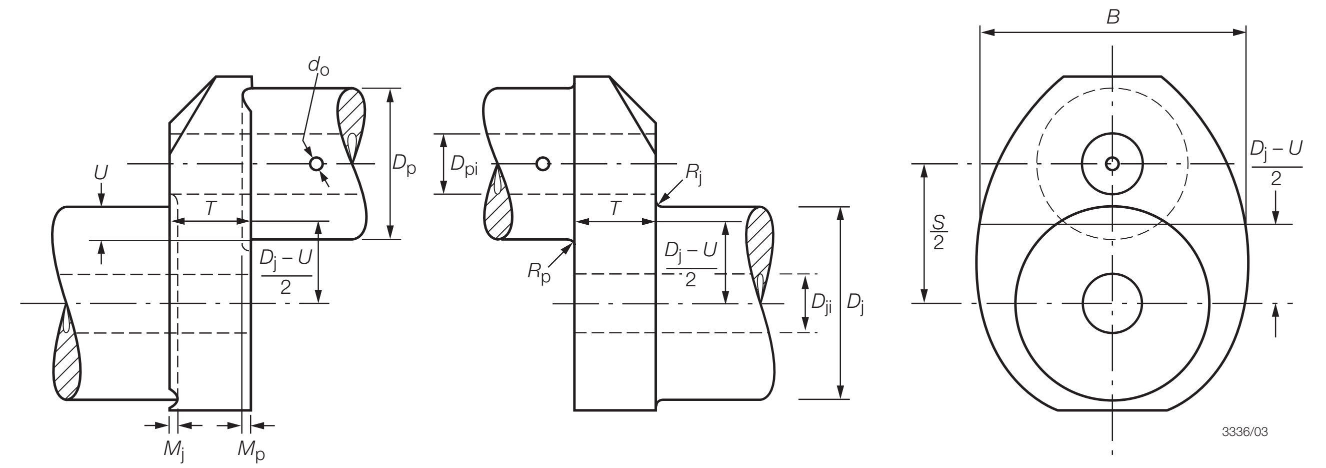

Fig. 2.3.2 Crank dimensions necessary for the calculation of stress concentration factors

3.4 Stress concentration factors

Table 2.3.1 Crankshaft variables

Variable	Range	
	Lower	Upper
$b = B/D_p$	~~1,20~~ 1,10	2,20
$d_j = D_{ji}/D_p$	0,00	0,80
$d_p = D_{pi}/D_p$	0,00	0,80
$m_j = M_j/D_p$	0,00	r_{jB}
$m_p = M_p/D_p$	0,00	r_p
$r_{jB} = R_j/D_p$	0,03	0,13
$r_{jT} = R_j/D_j$	0,03	0,13
$r_p = R_p/D_p$	0,03	0,13
$t = T/D_p$	0,20	0,80
$d = d_o/D_p$	0,00	0,20
$u = U/D_p$ *See* Note 2	~~–0,50~~	~~0,70~~ 0,50

NOTES

1. Where variables fall outside the range, alternative methods are to be used and full details submitted for consideration.
2. ~~A lower limit of u down to –0,7 is acceptable, but for calculation purposes the limit in this Table applies.~~
2. A lower limit of u can be extended down to large negative values provided that:
   (i) If calculated f(rec) < 1 then the factor f(rec) is not to be considered (f(rec) = 1)
   (ii) If u < –0,5 then f(ut) and f(ru) are to be evaluated replacing actual value of u by –0,5.

3.4.4 Crankpin oil bore stress concentration factors for radially drilled oil holes:

Bending

$$\gamma_B = 3 - 5{,}88 \bullet \frac{d_o}{D_p} + 34{,}6 \bullet \left(\frac{d_o}{D_p}\right)^2$$

Torsion

$$\gamma_T = 4 - 6 \bullet d_o \frac{d_o}{D_p} + 30 \bullet \left(\frac{d_o}{D_p}\right)^2$$

~~*3.4.4*~~ *3.4.5* Where experimental measurements of the stress concentrations are available, these may be used. The full documented analysis of the experimental measurements are to be submitted for consideration.

3.5 Nominal stresses

3.5.4 Nominal alternating bending stress in the outlet of the crankpin oil bore:

$$\sigma_{BON} = \pm \frac{M_{BON}}{Z_{crankpin}}$$

where

M_{BON} is taken as the 1/2 range value

$M_{BON} = \pm 1/2\ (M_{BOmax} - M_{BOmin})$

and

$M_{BO} = (M_{BTO} \cos\psi + M_{BRO} \sin\psi)$ *see* Fig. 2.3.3

The two relevant bending moments are taken in the crankpin cross-section through the oil bore.

M_{BRO} = bending moment of the radial component of the connecting-rod force

M_{BTO} = bending moment of the tangential component of the connecting-rod force

$Z_{crankpin} = \frac{\pi}{32} \frac{(D^4 - d^4)}{D \times Z_{crankpin}}$ related to the cross-section of axially bored crankpin.

~~*3.5.4*~~ *3.5.5* The nominal direct shear stress in the web for the purpose of assessing the main journal is to be added algebraically to the bending stress, using the alternating forces which have been used in deriving M_b in 3.5.3.

~~*3.5.5*~~ *3.5.6* Nominal stress is referred to the web cross-section area or the pin cross-section area as applicable.

Existing paragraphs 3.5.6 *to* 3.5.8 *have been renumbered* 3.5.7 *to* 3.5.9.

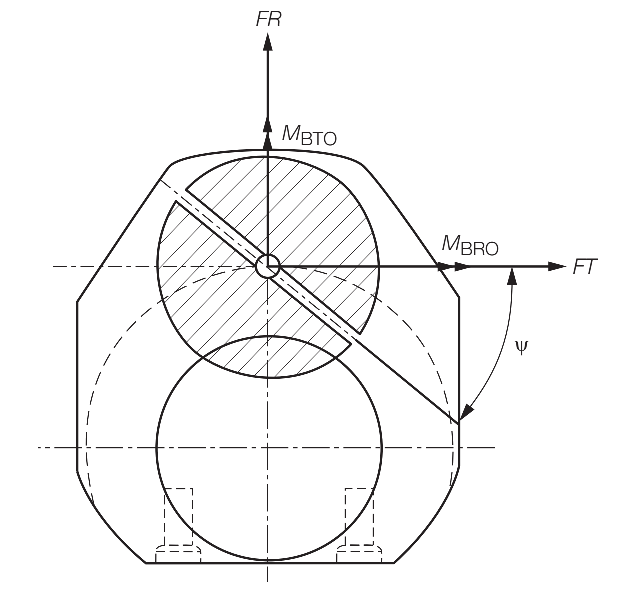

Fig. 2.3.3 Crankpin section through the oil bore

~~3.5.9~~ *3.5.10* Nominal alternating torsional stress:

$$\tau_a = \pm \frac{T_a}{Z_T} \text{ N/mm}^2$$

where

Z_T = torsional modulus of crankpin and main journal

$$\cancel{= \pi \frac{D^4 - d^4}{16D} \text{ mm}^3}$$

$$= \frac{\pi}{16} \left[\frac{(D^4 - d^4)}{D}\right] \text{ mm}^3$$

D = outside diameter of crankpin or main journal, in mm

d = inside diameter of crankpin or main journal, in mm.

τ_a is to be ascertained from assessment of the torsional vibration calculations where the maximum and minimum torques are determined for every mass point of the complete dynamic system and for the entire speed range by means of a harmonic synthesis of the forced vibrations from the 0,5th order up to and including the 12th order for 4-stroke cycle engines. Whilst doing so, allowance must be made for the damping that exists in the system and for unfavourable conditions (misfiring in one of the cylinders when no combustion occurs but only compression cycle). The speed step calculation shall be selected in such a way that any resonance found in the operational speed range of the engine shall be detected.

3.5.11 For the purpose of the crankshaft assessment, the nominal alternating torsional stress considered in calculations is to be the highest calculated value, according to the method described in 3.5.9, occurring at the most torsionally loaded mass point of the crankshaft system.

3.5.12 The approval of the crankshaft will be based on the installation having the largest nominal alternating torsional stress (but not exceeding the maximum figure specified by the engine manufacturer). For each installation it is to be ensured by calculation that the maximum approved nominal alternating torsional stress is not exceeded.

Existing paragraph 3.5.10 *has been renumbered* 3.5.13.

3.6 Maximum stress levels

3.6.2 Outlet of crankpin oil bore:

- Maximum alternating bending stress:

$$\sigma_{BO} = \gamma_B (\sigma_{BON} + \sigma_{ax}) \text{ N/mm}^2$$

where

γ_B = bending stress concentration factor, *see* 3.4.4

- Maximum alternating torsional stress:

$$T_{tob} = \gamma_T \tau_a \text{ N/mm}^2$$

where

γ_T = torsional stress concentration factor, *see* 3.4.4

τ_a = nominal alternating torsional stress in crankpin, in N/mm^2.

Existing paragraph 3.6.2 *has been renumbered* 3.6.3.

3.7 Equivalent alternating stress

3.7.2 Equivalent alternating stress for the outlet of the crankpin oil bore σ_{eob}, is defined as:

$$\sigma_{eob} = \pm \frac{1}{3} \sigma_{bo1} + 2 \sqrt{1 + \frac{9}{4} \frac{\tau_{to}^2}{\sigma_{bo}}} \text{ N/mm}^2$$

3.8 Fatigue strength

3.8.1 The fatigue strength of a crankshaft is based upon the crankpin and crank journal as follows:

$$\sigma_{fp} = K_1 K_2 (0{,}42\sigma_u + 39{,}3) \left(0{,}264 + 1{,}073 D_p^{-0{,}2} + \frac{(785 - \sigma_u)}{4900} + \frac{196}{\sigma_u} \sqrt{\frac{1}{R_p}}\right)$$

To calculate the fatigue strength in the oil bore area, replace R_p with $^1/_2\, d_o$ and σ_{fp} with σ_{fob}.

$$\sigma_{fj} = K_1 K_2 (0{,}42\sigma_u + 39{,}3) \left(0{,}264 + 1{,}073 D_j^{-0{,}2} + \frac{(785 - \sigma_u)}{4900} + \frac{196}{\sigma_u} \sqrt{\frac{1}{R_j}}\right)$$

where

σ_u = UTS of crankpin or crank journal as appropriate

K_1 = fatigue endurance factor appropriate to the manufacturing process

= 1,05 for continuous grain-flow (CGF) or die-forged

= 1,0 for freeform forged (without CGF)

= 0,93 for cast steel manufactured using a LR approved cold rolling process

K_2 = fatigue enhancement factor for surface treatment. These treatments are to be applied to the fillet radii.

A value for K_2 will be assigned upon application by the engine designers. Full details of the process, together with the results of full scale fatigue tests will be required to be submitted for consideration. Alternatively, the following values

may be taken (surface hardened zone to include fillet radii):

K_2 = 1,15 for induction hardened
= 1,25 for nitrided

Where a value of K_1 or K_2 greater than unity is to be applied, then details of the manufacturing process are to be submitted.

3.9 Acceptability criteria

3.9.1 The acceptability factor, Q, is to be greater than 1,15:

$Q = \frac{\sigma_f}{\sigma_e}$ for crankpin ~~and journal~~, journal and the outlet of crankpin oil bore

where

$\sigma_f = \sigma_{fp}$ or σ_{fj} or σ_{fob}
$\sigma_e = \sigma_{ep}$ or σ_{ej} or σ_{eob}.

3.10 Oil hole

3.10.1 The junction of the oil hole with the crankpin or main journal surface is to be formed with an adequate radius and smooth surface finish down to a minimum depth equal to 1,5 times the oil bore diameter.

3.10.3 When journal diameter is equal to or larger than the crankpin diameter, the outlets of main journal oil bores are to be formed in a similar way to the crankpin oil bores, otherwise separate fatigue strength calculations or, alternatively, fatigue test results may be required.

Section 4
Construction and welded structures

4.1 Crankcases

4.1.1 Crankcases and their doors are to be of robust construction to withstand anticipated crankcase pressures that may arise during a crankcase explosion, taking into account the installation of explosion relief valves required by Section 6, and the doors are to be securely fastened so that they will not be readily displaced by ~~an~~ a crankcase explosion.

4.3 Materials and construction

4.3.2 ~~Plates and weld preparations are to be accurately machined or flame-cut to shape. Flame-cut surfaces are to be cleaned by machining or grinding: if the flame-cut surfaces are smooth, wire brushing may be accepted.~~ Welding is to be carried out in accordance with the requirements of Chapter 13 of the Rules for Materials, using welding procedures and welders that have been qualified in accordance with Chapter 12 of the Rules for Materials.

4.4 Post-weld heat treatment

4.4.3 Omission of post-weld heat treatment of bedplates and their sub-assemblies will be considered on application by the Enginebuilder with supporting evidence in accordance with Ch 13,8.4 of the Rules for Materials.

4.5 Inspection

4.5.2 ~~On completion of welding and stress relief heat treatment, all welds are to be examined.~~ Inspection of welds is to be in accordance with the requirements of Ch 13,1.11 of the Rules for Materials.

Section 6
Crankcase safety fitting

NOTE For the purpose of this Section, starting air compressors are to be treated as auxiliary engines

6.1 Relief valves

6.1.1 Crankcases are to be provided with lightweight spring-loaded valves or other quick-acting and self-closing devices, ~~of an approved type,~~ to relieve the crankcases of pressure in the event of an internal explosion and to prevent any inrush of air thereafter. The valves are to be designed and constructed to open quickly and be fully open at a pressure not greater than 0,2 bar.

6.4 Vent pipes

6.4.1 Where crankcase vent or breather pipes are fitted, they are to be made as small as practicable and/or as long as possible to minimize the inrush of air after an explosion. Vents or breather pipes from crankcases of main engines are to be led to a safe position on deck or other approved position.

Section 7
Piping

7.3 Exhaust systems

7.3.4 Exhaust gases are to be led overboard and should be blown out in a direction away from the ship.

■ *Section 11*
Electronically controlled engines

11.1 Scope

11.1.1 The requirements of this Section are applicable to engines for propulsion, essential auxiliary and emergency power purposes with software-based electronic control of fuel, air and exhaust systems.

11.1.2 These engines may be of the slow, medium or high-speed type. They generally have no camshaft to drive fuel, air and exhaust systems, but have common rail fuel/hydraulic arrangements and hydraulic actuating systems for the functioning of the fuel, air and exhaust systems.

11.1.3 The operation of these engines relies on the effective monitoring of a number of parameters such as crank angle, engine speed, temperatures and pressures using one or more electronic control systems to provide the services essential for the operation of the engine such as fuel injection, air inlet, exhaust and speed control.

11.1.4 Deviation from Rule requirements are to be submitted and will be considered on the basis of technical justification by the Enginebuilder.

11.1.5 During the life of the engine any changes to hardware, software, control and monitoring systems which may affect the safety and reliable operation of the engine are to be submitted and approved by LR.

11.2 Plans and particulars

11.2.1 In addition to the plans and particulars required by Section 1 the following information is to be submitted:

(a) A general overview of the operating principles, supported by schematics explaining the functionality of individual systems and sub-systems. The information is to relate to the engine capability and functionality under defined operating and emergency conditions such as recovery from a failure or malfunction, with particular reference to the functioning of electronic control systems and any sub-systems. The information is also to indicate if the engine has different modes of operation, such as to limit exhaust gas emissions and/or to run under an economic fuel consumption mode or any other mode that can be controlled by electronic control systems.

(b) Details of hydraulic systems for actuation of sub-systems (fuel injection, air inlet and exhaust), to include details of the design/construction of pipes, pumps, valves, accumulators and the control of valves/pumps. Details of pump drive arrangements are also to be included.

(c) Failure Modes and Effects Analysis (FMEA) of the mechanical, pressure containing and electrical systems and arrangements that support the operation of the engine. The analysis is to demonstrate that suitable risk mitigation has been achieved so that a system will tolerate a single failure in equipment or loss of an associated sub-system such that operation of the engine will not be lost or degraded beyond acceptable performance criteria of the engine, *see* 11.5.

(d) A schedule of testing and trials to demonstrate that the engine is capable of operating as described in the design statement, and any testing required to verify the conclusions of the FMEA.

(e) Operating manuals which describe the particulars of each system and, together with maintenance instructions, include reference to the arrangements for making modifications and changes to electronic control systems and for the functioning of sub-systems.

(f) Quality plan for sourcing, design, installation and testing of all components used in the oil fuel and hydraulic oil systems installed with the engine for engine operation.

(g) Fatigue analysis for all high pressure oil fuel and hydraulic oil piping arrangements required for engine operation where failure of the pipe or its connection or a component would be the cause of engine unavailability. The analysis is to concentrate on high pressure components and sub-systems and recognise the pressures and fluctuating stresses that the pipe system may be subject to in normal service.

(h) Schedule of testing at Enginebuilders, pre-sea trial commissioning and sea trials. The test schedules are to identify all modes of engine operation and the sea trials are to include typical port manoeuvres under all intended engine operating modes.

(j) Evidence of type testing of the engine with electronic controls, or a proposed test plan at the engine builders with the electronic controls functioning, to verify the functionality and behaviour under fault conditions of the electronic control system.

11.2.2 In addition to the plans and particulars required by Pt 6, Ch 1 the following information for control, alarm, monitoring and safety systems relating to the operation of an electronically controlled engine is to be submitted:

(a) System requirements specification.
(b) Description of operation with explanatory diagrams.
(c) Line diagrams of control circuits.
(d) List of monitored points.
(e) List of control points.
(f) List of alarm points.
(g) List of safety functions and details of any overrides, including consequences of use.
(h) Details of hardware configuration.
(j) Hardware certification details.
(k) Software quality plan.
(l) System integration plan.
(m) Failure Mode and Effects Analysis (FMEA). *See* 1.1.4.
(n) Factory acceptance, integration, harbour and sea trials/test schedules for hardware and software.
(o) Software certification details.
(p) Quality plan for sourcing, design installation and testing of all components used in the control, alarm, monitoring and safety systems installed with the engine for engine operation.

11.3 Oil fuel and hydraulic oil systems

11.3.1 Oil fuel and hydraulic oil piping systems arrangements are to comply with Chapters 2, 10, 11, 12 and 13 as applicable.

11.3.2 Where pumps are essential for engine operation, not less than two oil fuel and two hydraulic oil pressure pumps are to be provided for their respective service and arranged such that failure of one pump does not render the other inoperative. Each oil fuel pump and hydraulic oil pump is to be capable of supplying the quantity of oil for engine operation at its maximum continuous rating and arranged ready for immediate use.

11.3.3 The oil fuel pressure piping between the oil fuel high pressure pumps and the fuel injectors is to be protected with a jacketed piping system capable of containing oil fuel leakage from a high pressure pipe failure.

11.3.4 The hydraulic oil pressure piping between the high pressure hydraulic pumps and hydraulic actuators is to be protected with a jacketed piping system capable of containing hydraulic oil leakage from a high pressure pipe failure.

11.3.5 Accumulators and associated high pressure piping are to be designed, manufactured and tested in accordance with a standard applicable to the maximum pressure and temperature rating of the system.

11.3.6 All valves, cocks and screwed connections are to be of a type tested type applicable to the maximum service conditions anticipated in normal service.

11.3.7 Isolating valves and cocks are to be located as near as practicable to the equipment to be isolated. All valves forming part of the oil fuel and hydraulic oil installation are to be capable of being controlled from readily accessible positions above the working platform.

11.3.8 High pressure oil fuel and high pressure hydraulic oil piping systems are to be provided with high pressure alarms with set points that do not exceed the system design pressures.

11.3.9 High pressure oil fuel and high pressure hydraulic piping systems are to be provided with suitable relief valves on any part of the system that can be isolated and in which pressure can be generated. The settings of the relief valves are not to exceed the design pressures. The valves are to be of adequate size and so arranged as to avoid an undue rise in pressure above the design pressures.

11.3.10 Equipment fitted for monitoring pressures and temperatures in the high pressure oil fuel and high pressure hydraulic oil systems is to comply with a Recognised Standard suitable to the anticipated vibration and temperature conditions.

11.3.11 A fatigue analysis is to be carried out in accordance with a standard applicable to the system under consideration and all anticipated pressure, pulsation and vibration loads are to be addressed. The analysis is to demonstrate that the design and arrangements are such that the likelihood of failure is as low as reasonably practicable. The analysis is to identify all assumptions made and standards to be applied during manufacture and testing of the system. Any potential weak points which may develop due to incorrect construction or assembly are also to be identified.

11.3.12 For high pressure oil containing and mechanical power transmission systems, the quality plan for sourcing, design, installation and testing of components is to address the following issues:

(a) Design and manufacturing standard(s) applied.
(b) Materials used for construction of key components and their sources.
(c) Details of the quality control system applied during manufacture and testing.
(d) Details of type approval, type testing or approved type status assigned to the machinery or equipment.
(e) Details of installation and testing recommendations for the machinery or equipment.

11.4 Electronic control systems

11.4.1 Plans and details of electronic control systems are to comply with Pt 6, Ch 1 and Ch 2 as applicable.

11.4.2 For electronic control systems and electrical actuating systems, the quality plan for sourcing, design, installation and testing of components is to address the following issues:

(a) Standard(s) applied.
(b) Details of the quality control system applied during manufacture and testing.
(c) Details of type approval, type testing or approved type status assigned to the equipment.
(d) Details of installation and testing recommendations for the equipment.
(e) Details of any local and/or remote diagnostic arrangements where assessment and alteration of control parameters can be made which can affect the operation of the engine.
(f) Details of arrangements for software upgrades.

11.4.3 The system integration plan is required to identify the process for verification of the functional outputs from the electronic control systems with particular reference to system integrity, consistency, security against unauthorised changes to software and maintaining the outputs within acceptable tolerances for safe and reliable operation of the engine within stated performance criteria.

11.5 FMEA analysis

11.5.1 A Failure Mode and Effects Analysis (FMEA) is to demonstrate that a failure of the functioning of an electronic control system:

(a) Will not result in the loss of the ability to provide the services essential for the operation of the engine, *see* Pt 6, Ch 1,2.8.2;
(b) Will not affect the normal operation of the services essential for the operation of the engine other than those services dependent upon the failed part, *see* Pt 6, Ch 1,2.9.4 and 2.9.5; and
(c) Will not leave either the engine, or any equipment or machinery associated with the engine, or the ship in an unsafe condition, *see* Pt 6, Ch 1,2.3.8, 2.4.6 and 2.9.5.

11.5.2 Where FMEA analysis is required to be carried out the reports submitted are to address the following issues:
(a) Identify the standards used for analysis and system design.
(b) Identify the objectives of the analysis.
(c) Identify any assumptions made in the analysis.
(d) Identify the equipment, system or sub-system, mode of operation and the equipment.
(e) Identify potential failure modes and their causes.
(f) Evaluate the local effects (e.g. fuel injection failure) and the effects on the system as a whole (e.g. loss of propulsion power) of each failure mode.
(g) Identify measures for reducing the risks associated with each failure mode. This may be through system design, provision of redundant systems and/or quality control procedures for sourcing, manufacture and testing.
(h) Identify trials and testing necessary to prove conclusions.

11.5.3 At sub-system level it is acceptable to consider failure of equipment items and their functions, e.g. failure of a pump to produce flow or pressure head. It is not required that the failure of components within that pump be analysed, and failure need only be dealt with as a cause of failure of the pump.

11.5.4 In an electronically controlled engine it is necessary to define the essential services on which the operation of the engine relies and the control functions, alarm functions and safety functions for the equipment and machinery providing these services. Examples of essential services are:
(a) Starting arrangements.
(b) Fuel supply arrangements.
(c) Lubricating oil arrangements.
(d) Hydraulic oil arrangements.
(e) Cooling arrangements.
(f) Power supply arrangements.

Part 5, Chapter 4

Main Propulsion Shafting

CORRIGENDUM

■ *Section 3* Design

3.2 Intermediate shafts

3.2.2 For shrink fit couplings *k* refers to the plain shaft section only. Where shafts may experience vibratory stresses close to the permissible stresses for continuous operation, an increase in diameter to the shrink fit diameter is to be provided, e.g. a diameter increase of 1 to 2 per cent and a blending radius as described in ~~3.8~~ 3.7.7

Part 5, Chapter 10

Piping Design Requirements

CORRIGENDA

■ *Section 4* Cast iron

4.2 Grey cast iron

4.2.1 Grey case iron pipes, valves and fittings will, in general, be accepted in Class III piping systems except as stated in ~~4.2.4~~ 4.2.3.

■ *Section 8* Flexible hoses

8.2 Applications

8.2.2 Rubber or plastics hoses, with integral cotton or similar braid reinforcement, may be used in fresh and outboard cooling water systems. In the case of outboard water systems, where failure of the hoses could give rise to the danger of flooding, the hoses are to be suitably enclosed, as indicated in ~~Ch 11,2.8~~ Ch 11,2.7.

Part 5, Chapter 11
Ship Piping Systems

CORRIGENDA

■ *Section 2* Construction and installations

2.3 Valves – Installation and control

2.3.5 Remote~~ly~~ controls of valves on passenger ships situated above the bulkhead deck are to be clearly indicated.

■ *Section 6* Pumps on bilge service and their connections

6.2 General service pumps

6.2.2 Sanitary, ballast, bilge or general service pumps may be accepted as fire pumps, provided that for ships other than passenger ships they are not used for pumping oil and that, if they are subject to occasional duty for the transfer or pumping of oil fuel suitable change-over arrangements are fitted to preclude the admission of oil into the fire main ~~fuel~~.

Part 5, Chapter 12
Machinery Piping Systems

CORRIGENDUM

■ *Section 4* Oil fuel pumps, pipes, fittings, tanks, etc.

4.9 Fresh water piping

4.9.2 ~~Fresh water tanks are to be separate and distinct from other tanks carrying flammable or sanitary liquids, *see also* Pt 3, Ch 7,1.6.~~ Potable fresh water tanks are to be fitted into a cofferdam, *see* Pt 3, Ch 7,16.

Part 5, Chapter 13

Piping Systems for Ships Intended for the Carriage of Liquids in Bulk

CORRIGENDA

■ *Section 1*
General requirements

1.5 Cargo zone

1.5.1 For definition of cargo zone, *see* Pt 4, ~~Ch 6,1.1~~ Ch 4,1.1.

1.6 Cargo pump rooms

Table 13.1.1 Alarms and safety arrangements

Item	Alarm	Note
Temperature sensing of bulkhead shaft glands, bearings and pump casings	High *see* Note	Cargo, ballast and stripping pumps
Bilge level	High	
Hydrocarbon concentration	High	> 10% LEL

NOTE
The alarm signals shall trigger continuous visual and audible alarms in the cargo control room or the pump control station.

■ *Section 3*
Cargo handling system

3.5 Cargo segregation

3.5.3 Spectacle Flanges could be accepted in vapour return systems with the ~~exemption for~~ exception of tankers carrying toxic cargoes Class 6.1.

Part 5, Chapter 14

Requirements for Fusion Welding of Pressure Vessels and Piping

CORRIGENDA

■ *Section 2*
Manufacture and workmanship of fusion welded pressure vessels

2.1 General requirements

2.1.7 It will be necessary for the Surveyor to visit the works for the purpose of inspecting the welding plant, equipment and procedures, and to arrange for the carrying out of preliminary tests to demonstrate the quality of the welding. These tests are to be carried out by the firm under the supervision of the Surveyor. The test requirements will be based on the welding process used, but are to be similar to those described in ~~3.4.4 and 3.4.5~~ Ch 13,4.8.4 and Ch 13,4.8.5 of the Rules for Materials.

■ *Section 3*
Routine weld tests for pressure vessels

3.4 Mechanical testing requirements

(*Part only shown*)
3.4.5 **Transverse bend test**. The bend test specimens shall meet the following:

(b) The specimens are to be in accordance with ~~Ch 11,2.1.3~~ Chapter 11 of the Rules for Materials.

Part 5, Chapter 15

Steering Gear

CORRIGENDUM

■ *Section 3* Construction and design

3.4 Flexible hoses

3.4.2 ~~Hoses for steering gear are to be replaced after 10 years of service or as per manufactured recommendations or as dictated by Surveyors.~~ The service lifetime of the flexible hoses for the steering gear is not to exceed the Manufacturer's recommendations. In all cases the hoses are to be replaced after 10 years of service.

Part 5, Chapter 17

Steerable Bow Thrusters

CORRIGENDA

■ *Section 1* General requirements

1.1 Application

1.1.1 This Chapter applies to bow thruster units intended for manoeuvring having a power of 110 kW and over, fitted on ships with a length exceeding 110 m. *See* Ch 1,5 or where a fire in the main machinery space ~~could put the main propulsion engine(s) out of action~~ incapacitates the main engines. *See* Ch 1,4.3.4.

■ *Section 2* Performance

2.1 General

2.1.1 The arrangement of the bow thruster is to be such that the ship can maintain a speed of not less than ~~7 km/h~~ 6,5 km/h also in the unloaded condition and can be satisfactorily propelled in accordance with ~~as per~~ Ch 1,5. The steering gear of the bow thrust unit is to be provided with two independent means of steering in compliance with Ch 15,2.1.1 ~~as far as applicable~~.

Part 6, Chapter 2

Electrical Installations

CORRIGENDUM

■ *Section 10* Accessories – Construction and testing

10.3 Socket outlets and plugs

10.3.2 All socket outlets of current rating ~~15 A~~ 16 A or more are to be provided with a switch.

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